

# Designing a Process for Executing Projects Under an International Agreement

Dr. Srinivas N Mohan  
Jet Propulsion Laboratory  
California Institute of Technology  
T1710F, 4800 Oak Grove Drive  
Pasadena, CA 91109  
818-354-5830  
[Srinivas.N.Mohan@jpl.nasa.gov](mailto:Srinivas.N.Mohan@jpl.nasa.gov)

**Abstract**—Projects executed under an international agreement require special arrangements in order to operate within confines of regulations issued by the State Department and the Commerce Department. In order to communicate enterprise-level guidance and procedural information uniformly to projects based on interpretations that carry the weight of institutional authority, a process was developed. This paper provides a script for designing processes in general, using this particular process for context. While the context is incidental, the method described is applicable to any process in general. The paper will expound on novel features utilized for dissemination of the procedural details over the Internet following such process design.

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## 1. INTRODUCTION

Projects executed under an international agreement have special obligations imposed upon them by virtue of State Department and Commerce Department regulations. This calls for specific understandings to be negotiated and documented in a Letter of Agreement or a Memorandum of Understanding between a federal agency and a foreign government entity, and further coordination with foreign partners during various phases of the project. The LOA and MOU negotiation entails administrative scrutiny both institutionally and by the sponsor. While it is not the purpose of this paper to delve into the content or the specifics of the process itself, the methodology developed in deconstructing and communicating an otherwise complex process is very much the intended subject of discussion.

## 2. DATA GATHERING

In designing a process to suit the institutional needs, it is necessary to first gather information in order to become acquainted with the details of all involved steps/activities and assess the correctness of data collected. Next, the process designer must become acquainted with all possibilities that may modulate the basic set of rules and recognize conditions that could arise from varied situations. This, in turn, helps set up the intrinsic logic, the flow of information and the structure of workflows involved. The most rudimentary approach following data gathering would be to represent the information flow and activities in a block diagram form and synthesize one large, single diagram. However, with any appreciable level of involved complexity, such a representation soon becomes unbounded in terms of size and its usefulness diminishes proportionally.

This leads one to think of the process in a hierarchical fashion. There are activities that are very detailed and belong at fairly low levels of the process structure, while others clearly belong at the top-level. Any activity represented in the process flow is held in equal regard relative to the rest of the activities in the process or it would not exist at all at any level. It takes initial data gathering, organizing, development of a structure, and embedding of details within it, in order to emerge with an initial process description. At the conclusion of these steps outlined, one has enough information to put down on paper what the process may look like. This must be followed by validation that the structure is conveying the correct level of institutional guidance to the end user - in this instance, the end users are project personnel engaged in executing a project with the involvement of foreign partners under an international agreement. The question is, what are the institutional rules whether imposed internally or external to the organization; and, what must the project personnel pay attention to during project execution over the entirety of its life-cycle phases. Further, what must the project personnel specifically do in order to maintain compliance with the rules? Also, what are the aids necessary to assist projects in following the process? This provides the motivation.

In going through the steps of initial data gathering and deriving an initial process flow, the process may appear to

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<sup>2</sup> IEEEAC paper #1010, Initial submit Oct 11, 2002

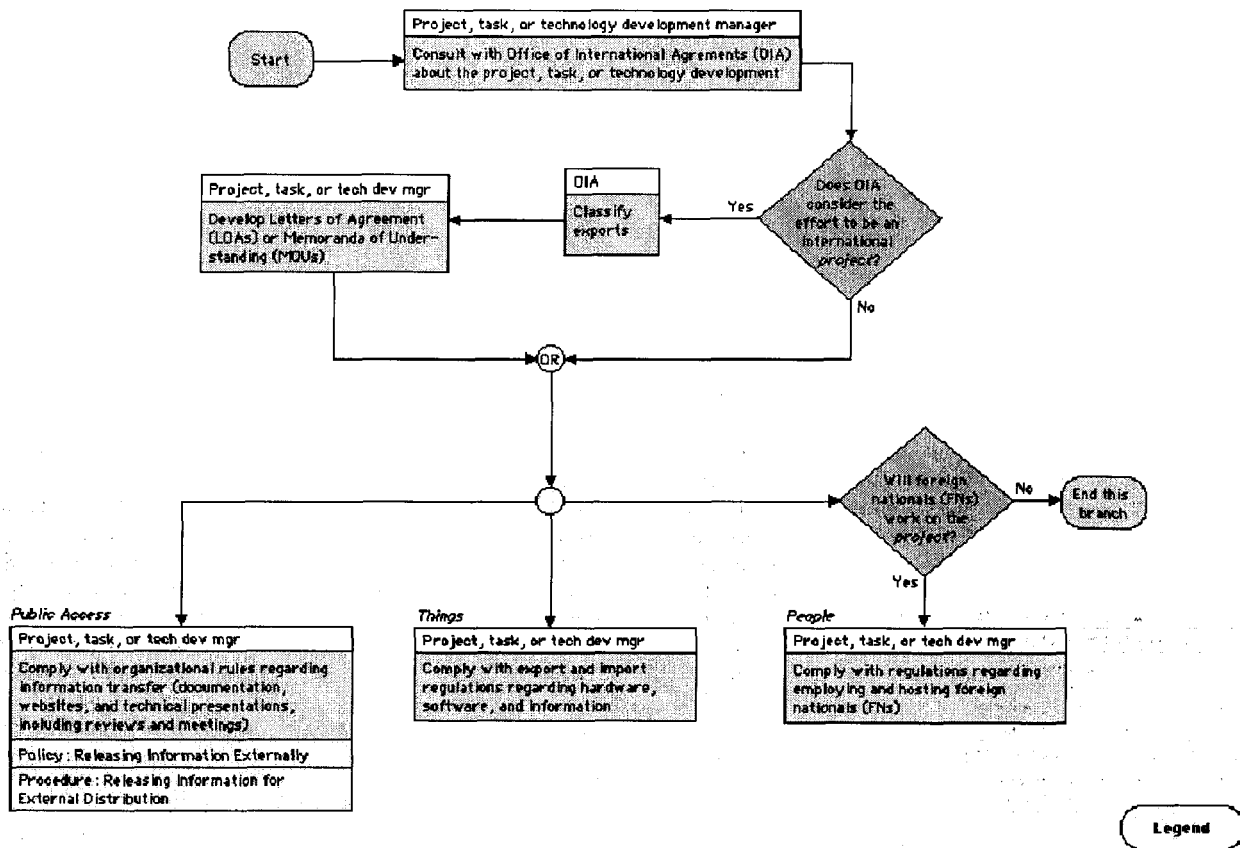


Figure 1 – Top-level Process Flow Diagram

be composed of numerous activities which are mutually linked in some convoluted fashion with chains of activities that may have no lower level detail, while there are others which may appear to have obvious lower-level presenting detail. Some of the activities may be conditional upon certain criteria being met, i.e., parts of the process flow may or may not apply to a given user. Not everything may fit together neatly. Never the less, one is impelled to synthesize an initial set of process flow diagrams for discussion with the content experts. In fact, if one were able to generate a single large diagram, one may begin to see aggregations of activities that could be grouped together and a box drawn around the collection with preferably a single input going into and a single output coming out of the box so drawn. Such segmentation could lend itself to a nested representation. Conceptually, this is exactly what was done in designing this process.

In addition to the collection of activities so identified, there may be references to institutional rules, other procedural documents, indigenous notes, and links to

other web sites that may contain related guidance and forms needed etc. This was viewed as an opportunity to bring together all of the elements needed to get the job done from the user's perspective.

In the example studied, the evolution of detail together with an evolution of the process structure led eventually to a set of nested flow diagrams.

### 3. STEPS IN THE PROCESS DESIGN FOR WEB IMPLEMENTATION

For the process under consideration, all activity had to be filtered through an organizational element that maintains institutional oversight on matters of international participation in projects. This was common to all ensuing steps in the process. The burden to initiate action rested with the project manager. This suggested a simple block diagram representation with the actor specified along with the activity required. See the top-level diagram shown in Figure 1. Each of the boxes has

an actor at the top, next the activity itself, and any links to pertinent information.

In developing the nested set of process flow diagrams, some basic conventions were adopted with the premise that the diagrams would be ported to the web, which they were. Web implementation is advantageous in many ways and is the preferred contemporary method for making the data available to a large community of users in a uniform manner. Although not dealt with in this paper is the issue of security. Whenever sensitive data are involved, a multi-layer access control becomes necessary. For the current situation, access is restricted to the company's intranet.

The conventions used in the process representation are set forth in the legend (see Figure 2). The web implementation is designed to invoke the legend by merely traversing the cursor across the box in the lower right hand corner of each diagram (seen in Figure 1 and every other diagram in the linked set). The controlling scripts cause the legend shown in Figure 2 to pop-up in a new window.

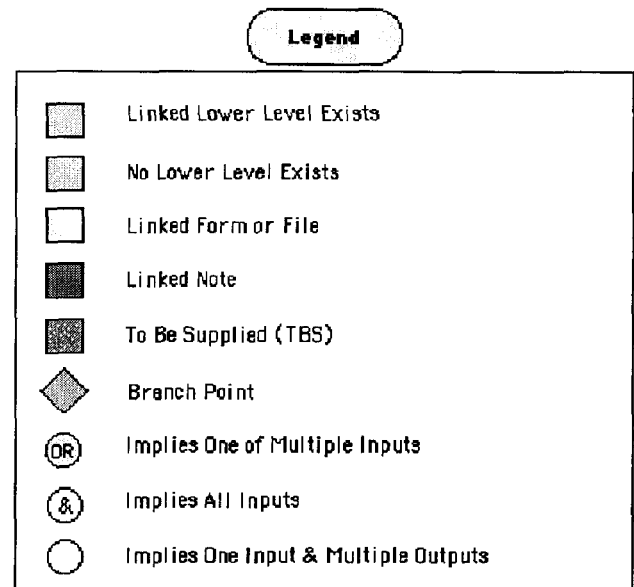


Figure 2. Conventions used in flow-charting

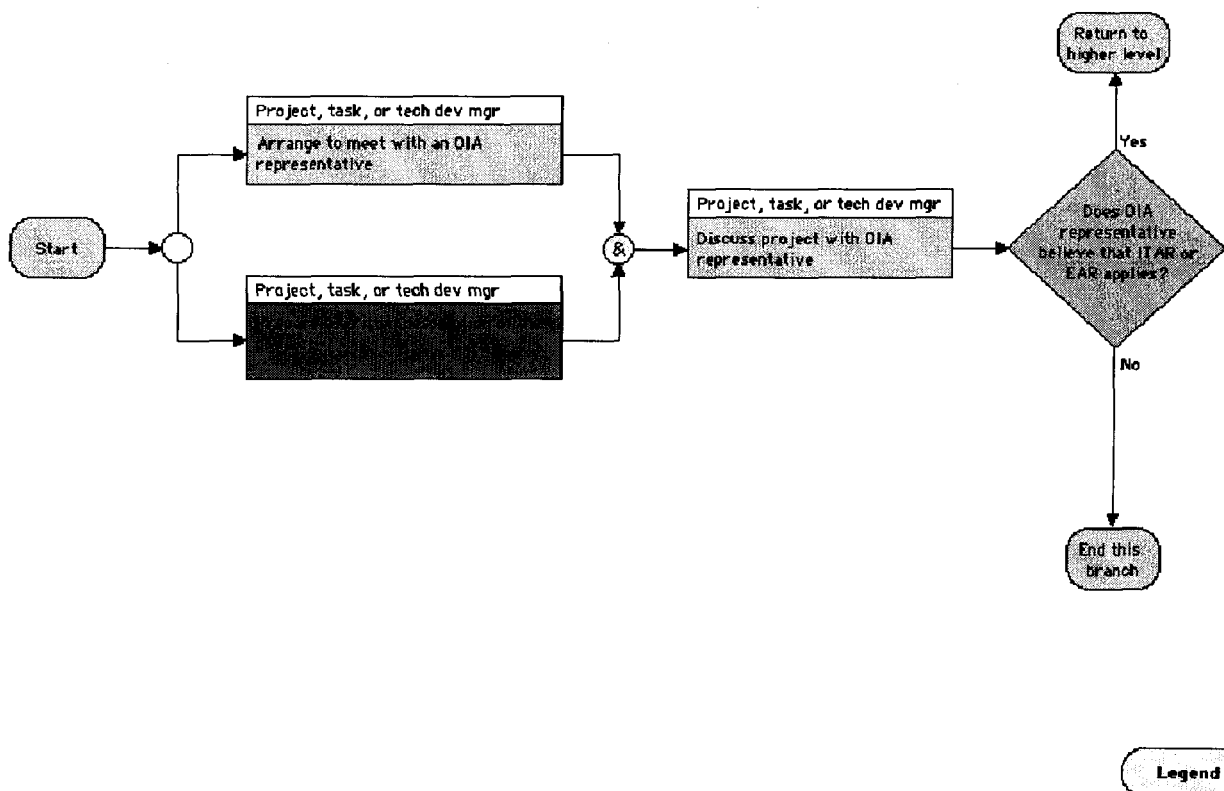


Figure 3 – Lower-level process flow diagram: "Consult with the Office of International Agreements"

Thus the conventions accompanying the process-flows are kept within easy reach whenever that need may arise at the user end.

A color scheme was adopted to make the access to linked information intuitive from the user's viewpoint. For example, the peach colored activity boxes signal that there is lower-level detail present. The detail is intended to be accessed with "point and click" on the peach colored box of interest. The yellow boxes signal that there are linked company documents and/or forms needed for making appropriate inputs to internal process elements under consideration.

The branch points have relevant decision criteria clearly identified and are self-explanatory. The flow-charting follows the NIST convention with minimal deviation. There flow-charts use three different types of nodes, these are all shown in Figure 2. In many instances there are procedural notes appended to a given activity that are colored green (see Figure 3 for an example). The notes are opened in a new window with a green background. There are three window sizes selected for the display of information, one each for 1) the process flow diagrams, 2)

the linked notes and 3) any linked websites, respectively. The windows open automatically and are sized appropriately to lend a uniform look and feel and allow the user to follow and get used to the intent behind the style of presentation. These features are built in and are controlled via scripts.

Once the user is past this initial, get-acquainted threshold, even the unfamiliar user is able to navigate through the linked information rapidly and intuitively.

The top-level diagram contains only five activities and two branch points. For the purpose of illustration we will follow the first two boxes to their lower levels of detail. These are shown in Figures 3 and 4 respectively.

#### 4. DRILL-DOWN TO LOWER-LEVEL DETAIL

The web implementation is structured to present the lower level flow diagram upon demand with point and click ease. Figure 3 shows the necessary steps for "the initial consultation" to make a determination as to applicability

### Develop Letters of Agreement (LOAs) or Memoranda of Understanding (MOUs)

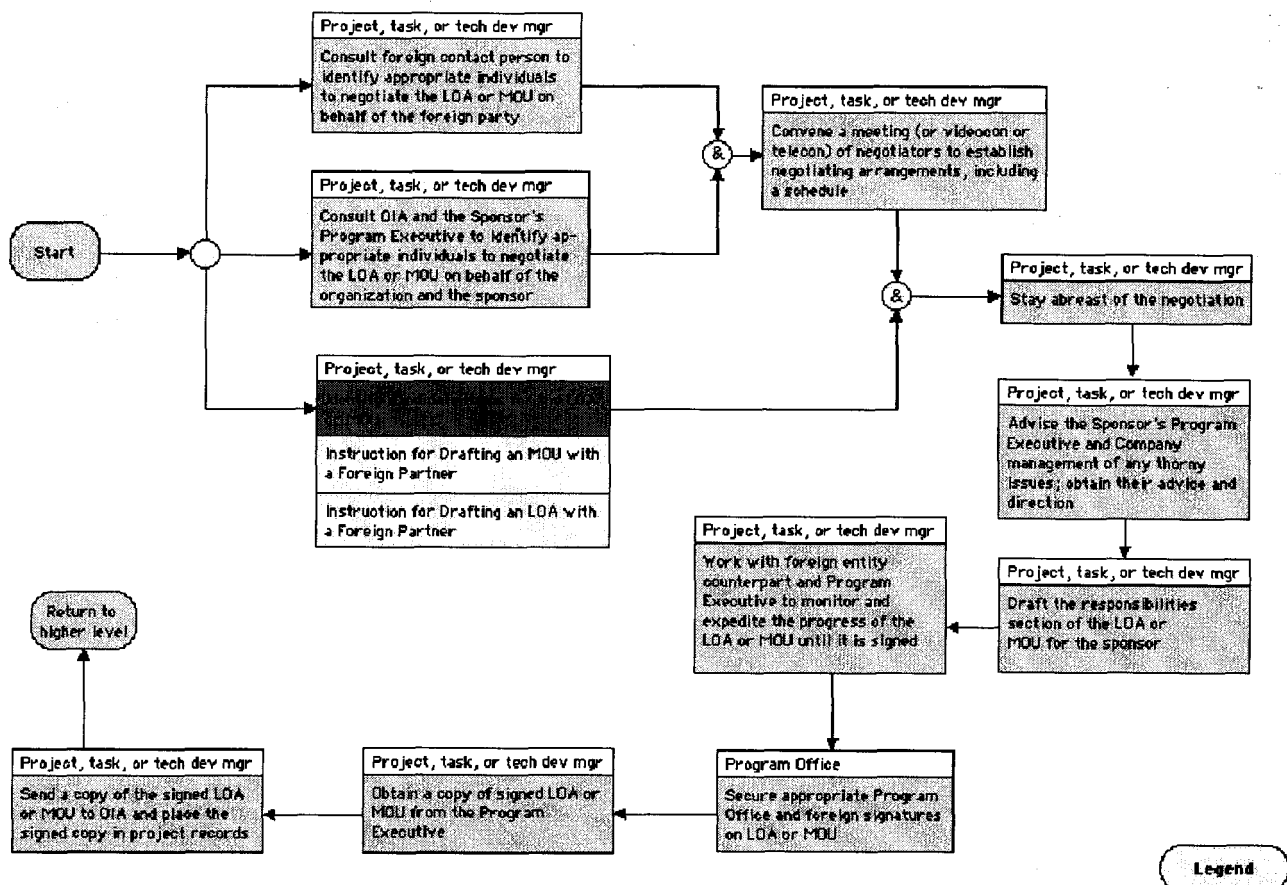


Figure 4 – Lower-level process flow diagram: "Develop Letters of Agreement and MOUs"

of ITAR and EAR regulations. Similarly, Figure 4 displays the lower level detail for developing LOA's and MOU's. Both are linked to peach colored boxes in Fig 1.

Certain basic information about the project must be submitted. This is outlined in a note that is linked to the green box in Figure 3. See detail in Figure 5. Thus the user is able to drill-down for detail that is necessary for preparing the ground-work for this consultative step.

The process designer must note that simplicity, clarity, as well as brevity of the style of presentation are paramount. This is key to defining any procedural detail in any process. The designer of the process must pay attention to sufficiency of information presented while striving for brevity and the precision of the language used to convey the institutional edict, whatever it may be. At each step, the process designer must examine the activity statement for ambiguity and the possibility of misinterpretation.

The appended set of notes linked to the green boxes in Figure 3 and 4 - shown below for illustrative purposes in Figures 5a & 5b, respectively.

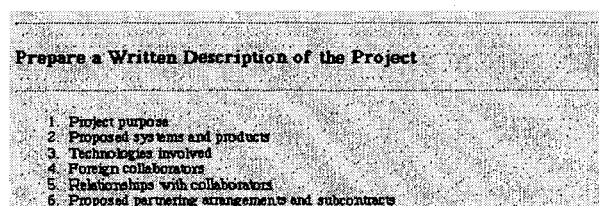


Figure 5a. Detail of sample appended note in figure 3

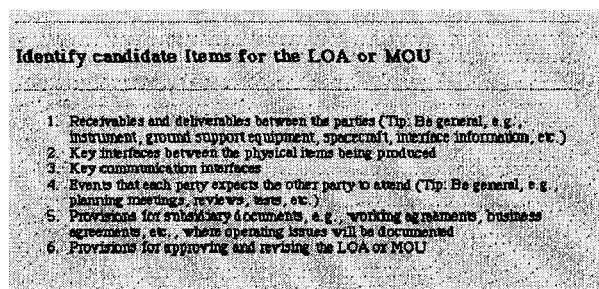


Figure 5b. Detail of sample appended note in figure 4

It merely directs the project personnel in this instance to provide rudimentary information concerning the project to assist with the intended initial consultation.

The link to the policy on "releasing information externally" shown in yellow in Figure 1 will similarly cause the company's policy in this regard to appear in a new browser window (see illustration, Figure 6).

Similarly, the lower yellow box in Figure 1 links a procedure governing the release of information for external distribution (Figure 7). The procedure has both required steps and optional steps, which are clearly indicated. The procedure may have hot links to required forms, optional

forms, sample documentation etc. Effectively, this process design methodology allows other process detail developed by other parts of the company to be integrated into the workflow here and incorporated directly within it.

#### Policy Statement

Information intended for external release must be approved prior to release by management and also by document review. This includes Web sites, conference papers, journal articles, technical presentations or publications, policy statements, scientific or technical information, or information made available via an information server.

In releasing information electronically (e.g., via Web or ftp sites), references and links must be business related and must not lead to an apparent conflict of interest, or implied endorsement.

Figure 6. Sample of linked company policy on "releasing information externally", linked to figure 1, (top yellow box)

This has the advantage of preserving the proper context and assuring completeness when the user attempts to follow company rules, guidelines, policies and procedures. The user cannot overlook that which has been made obvious. Specifically, there are no indirect references.

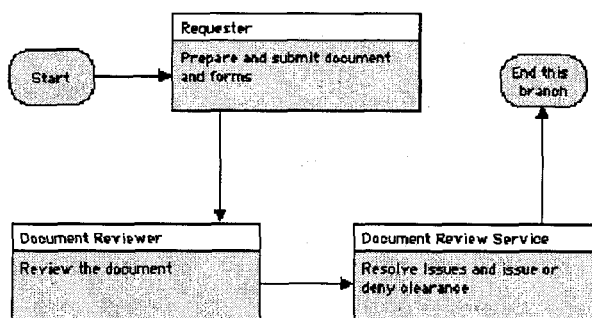


Figure 7. Sample linked procedure governing "release of external information" linked to figure 1, (lower yellow box)

Indirect references by their very nature increase the burden upon the person it is intended for. As an extreme example of such burden, consider hypothetically, command media written with multitudinous and unbounded cross referencing, without any sensitivity towards those who must operate within the limits set by those command media in order to get their job done and accomplish a company's primary mission goal. Such an organization of command media implies that everything is implicitly linked to everything else. There is no beginning and there is no end. The burden on the workers of the company is increasing for they must analyze the body of information presented and correctly interpret the intent behind whatever has been presented to them. Even the IRS publications might begin to look more organized and simpler by comparison. Such an organization of command media, or lack thereof, greatly increases the burden imposed on company employees in carrying out their day-to-day activities. Adherence to defined processes

remains true only on paper. Those affected by the process cannot admit that they are not following the process purely because of the implied admission of violation of company-imposed rules. Actual practice however must begin to deviate from that which is written down and intended-to-be-followed, purely as a natural consequence of the burden imposed. Let us imagine for a moment that the procedure controlling "the release of information externally" was written in tabular form, with step-by-step responsibility of each involved person in the chain, along with other prescriptive detail. Let us further imagine that all procedures designated for implementation and flowing down in a requirements sense from the command media were written in this form. This can represent an enormous escalation of the burden upon a company's workforce. The root cause of this escalation is a "requirements centric" approach. Requirements must of course be identified and stated at the appropriate level of each activity.

By contrast, a process-centric view would hold that any process based management system must place primary emphasis on efficient implementation of organizational processes. The requirements are thus contextually linked to the processes and defined activities within each process. For it is the defined activity that implements each element of a defined process. It is the collective implementation of all of the processes of a given organization as intended by it, which assure its success in business.

Needless to say that by assumption, the processes were drawn up by the company's system developers to further the company's mission goal. If we examine the components of the "burden" that a requirements-centric approach levies upon the company workforce, they may look something like this:

1. inability to comprehend clearly at the working level, the intent of prescriptions, set forth in the command media by higher-level management personnel.
2. compliance anxiety driven by defined consequences where the workforce is overwhelmed by the continued invention of "new rules" being added to an already overburdened and growing collection of rules that no one can keep up with
3. guaranteed deviation resulting from over saturation of rules stemming from a requirement centric-world and the resulting anxiety suffered by implementers
4. inability to find relevant information in a "sea" of recorded prescriptions and time wasted in its search and so on.

Is there a "cost" associated with this burden? Can this hidden cost be quantified? How much real money could be saved if the command media and procedural guidelines were more streamlined? Could they be streamlined to consciously reduce the burden? What effect could it have on the morale of the workforce? What economies of scale

can be achieved? While the answers to these questions are beyond the scope of this paper, there is at least an indication of the direction to be taken, which can be gleaned from the exercise chronicled in this paper.

Returning to the process design, and for illustrative purposes, a procedure is shown in Figure 7 that relates to external release of information. It is activated by clicking on the top yellow link in Figure 1, which causes this procedure to appear in a new browser window. If the policy (shown in Fig 6) is already open in its window, it is replaced by the procedure (shown in Fig 7, which displays the "how to's" relative to releasing information for external distribution)

The diagram contained in Figure 7 has peach colored boxes implying by the convention noted in Figure 2 that there is underlying lower level detail for each of the three identified activities within this procedure. Specifically, this diagrammatic approach could replace all of the textual stepwise prescriptions in tabular form containing actor/action etc.

## 5. THE COMPLETE DESIGN

While this suffices to convey the basic structure adopted, the website that resulted from the process design activity chronicled in this paper, is in actuality considerably broader in scope and larger. It has a great deal more detail than is possible to include in these pages. The final procedural flow for this particular example pertaining to "execution of projects under an international agreement", consists of over 30 individual diagrams, several linked notes of the type shown in Fig 5, and all possible links to company rules and procedures of the type shown in Figures 6 and 7. If this material were presented in the traditional format of a text procedure, it is estimated that the number of pages could multiply ten fold; and, the linked material would have to be segregated under tabs to assist the reader in finding indirectly referenced -material. Users would be disincentivized from using such an intimidating rulebook.

The net result is a detailed procedural roadmap for the end user, augmented by governing company policies and procedures and ancillary aids such as linked guidance, forms etc.. As an aside, one may observe that the spirit of the provisions contained in the ISO 9001 standard has been addressed by the process design illustrated in this paper.

## 6. SUMMARY

This paper has attempted to provide a minimal account of the design intent relating to processes. The principles can be extended to virtually any process and can describe the entire overarching set of processes relating to design, development, fabrication of hardware, software coding, hardware and software testing, integration, validation and operation of spacecraft, space borne instruments, landers

and rovers, etc. The scope of the notions presented in this paper is therefore quite broad and the potential for streamlining the management processes applicable to unmanned flight projects is significant. In using the methodology suggested, judgment must be exercised to direct it towards complex processes/procedures (leaving out the real simple ones).

Subject matter experts may not view the process engineering details with the same enthusiasm as the core content. The organization must therefore recognize the importance of making available process engineers who should be given the opportunity to work with subject matter experts, in order to apply the discipline outlined in this paper.

Prior to reducing the procedural flows to diagrammatic form, there is an important intervening analytical step that is part of the logical dictate. One must sequence the activities of any given process in an optimal fashion so as to minimize the utilization of resources by identifying where concurrencies must exist in any given system development, be it for a project, technology development, or a task. At the heart of this subject is the consideration of efficient teaming and a mission architecture that will optimize all technical communication. This subject is quite broad in itself and the reader is directed to reference [1] for a detailed discussion.

Further, if company procedures are developed in a manner similar to that described in this paper (and illustrated in examples shown in Figures 1 through 7); and further, if all of the company's procedures are designed with the principles outlined in this paper, the answers to some of the questions raised earlier may become apparent. Significant savings in burden-cost are possible if deliberate reduction in the true "burden" imposed on the company's workforce is undertaken. As noted earlier, these are unspecifiable costs, not easily perceivable, nor quantifiable, unless a comparative study is undertaken. Such a study may be far less important, in view of the fact that considerable time must elapse before convincing evidence is brought forth, appreciated, and turned into a company initiative, and then funded as a recognized activity. For one thing a study of this type may be prohibitively expensive and may even be infeasible for lack of necessary information required to conduct such an analysis. The expense of initiating such an effort without analysis may well be worth the rewards that could potentially far exceed any initial cost.

#### Acknowledgement

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#### REFERENCE

- [1] Srinivas N Mohan, *Managing Unmanned Flight Projects using Methods in Complex Product development*, Paper 266, presented at the IEEE Aerospace Conference, Big Sky, Montana, March 2002.

Srinivas N Mohan received his Doctor of Philosophy Degree in Astronautical Sciences from Stanford University in 1970. He is currently a member of Senior Technical Staff in the Project Planning and Management Information Systems Group at the Jet Propulsion Laboratory in Pasadena, Calif. Srinivas has worked on a wide range of technical and management aspects associated with unmanned flight projects. One of his current interests is in applying product development approaches and process design methodology presented in this paper to the system development and management of flight projects at JPL and make the case for a DSM based approach to mission architecture development, flight project management, and streamlining institutional processes to reduce the overall burden on projects, internal technical directorates, their divisions and sections.

